Title: METHOD OF PROVIDING
BOARD PACKAGING LINE
PROGRAM
Inventor(s): Hiroshi YOSHIDA et al.
DOCKET NO.: 044499-0179

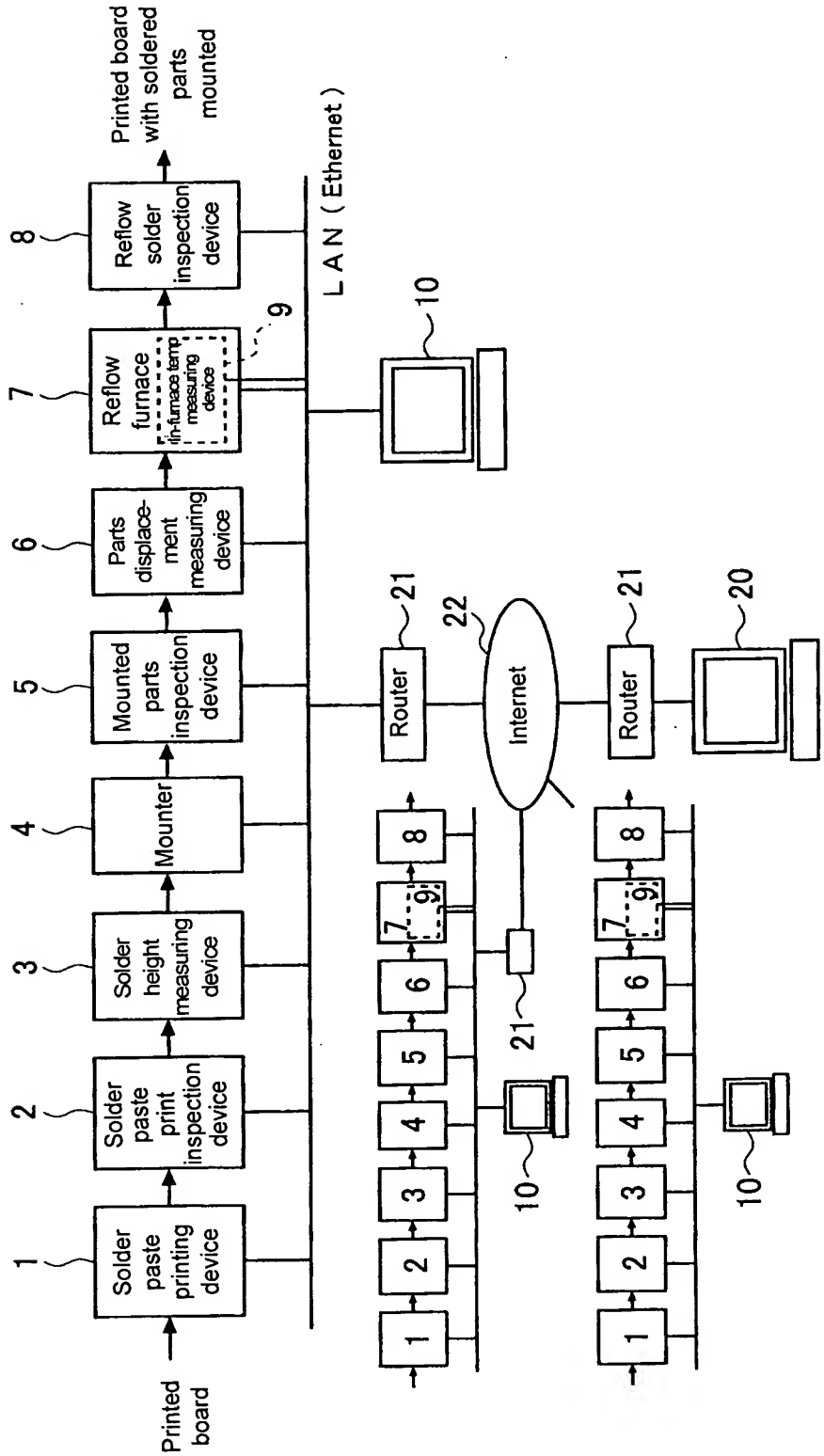


Fig. 1

Fig. 2

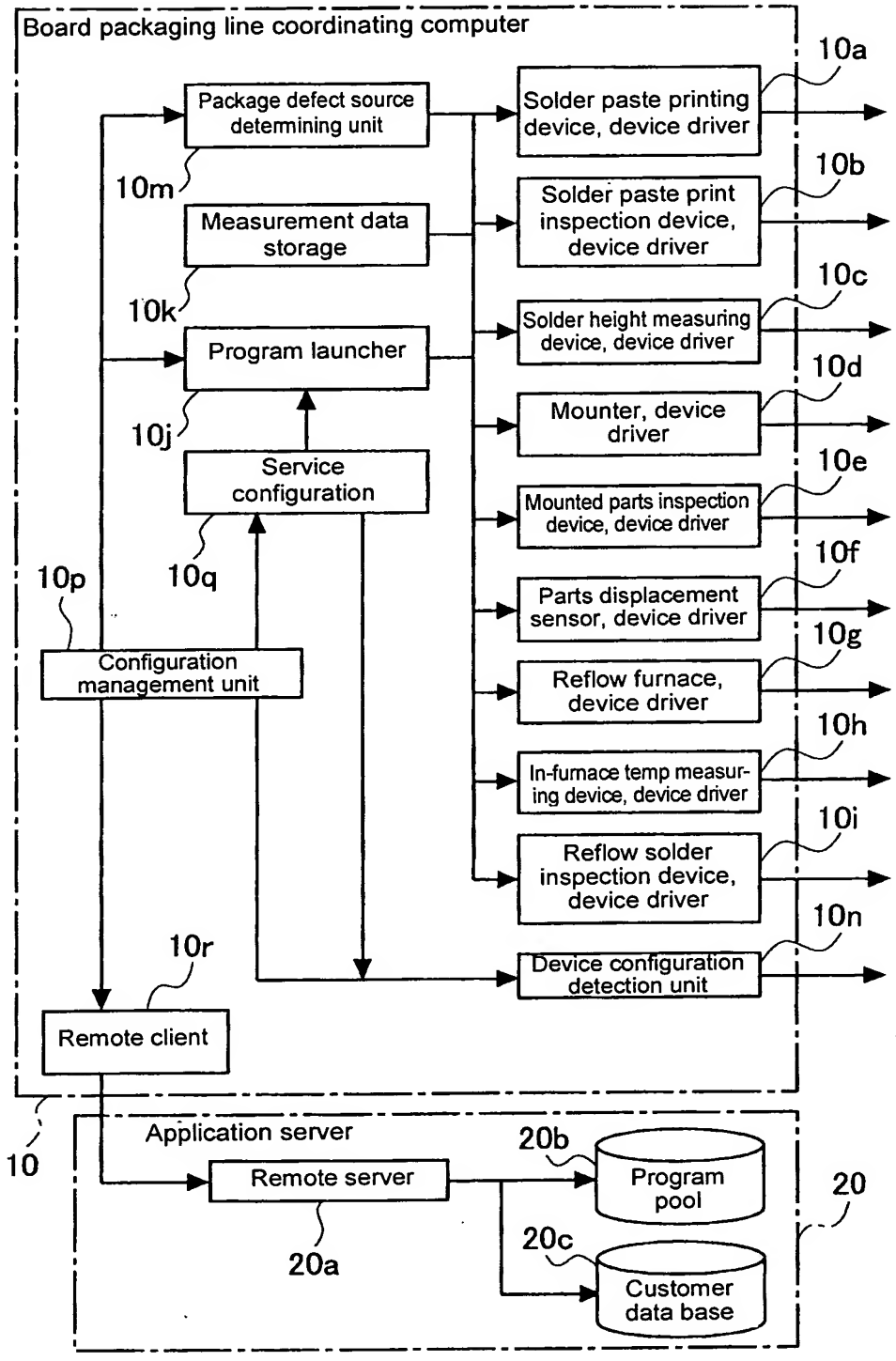

Board packaging line coordinating computer
Package defect source determining unit
10m
Measurement data storage
10k
Program launcher
10j
Service configuration
10q
10p
Configuration management unit
10r
Remote client
10
10a
Solder paste printing device, device driver
10b
Solder paste print inspection device, device driver
10c
Solder height measuring device, device driver
10d
Mounter, device driver
10e
Mounted parts inspection device, device driver
10f
Parts displacement sensor, device driver
10g
Reflow furnace, device driver
10h
In-furnace temp measuring device, device driver
10i
Reflow solder inspection device, device driver
10n
Device configuration detection unit
Application server
Remote server
20a
20b
Program pool
20c
Customer data base
20

Fig. 3

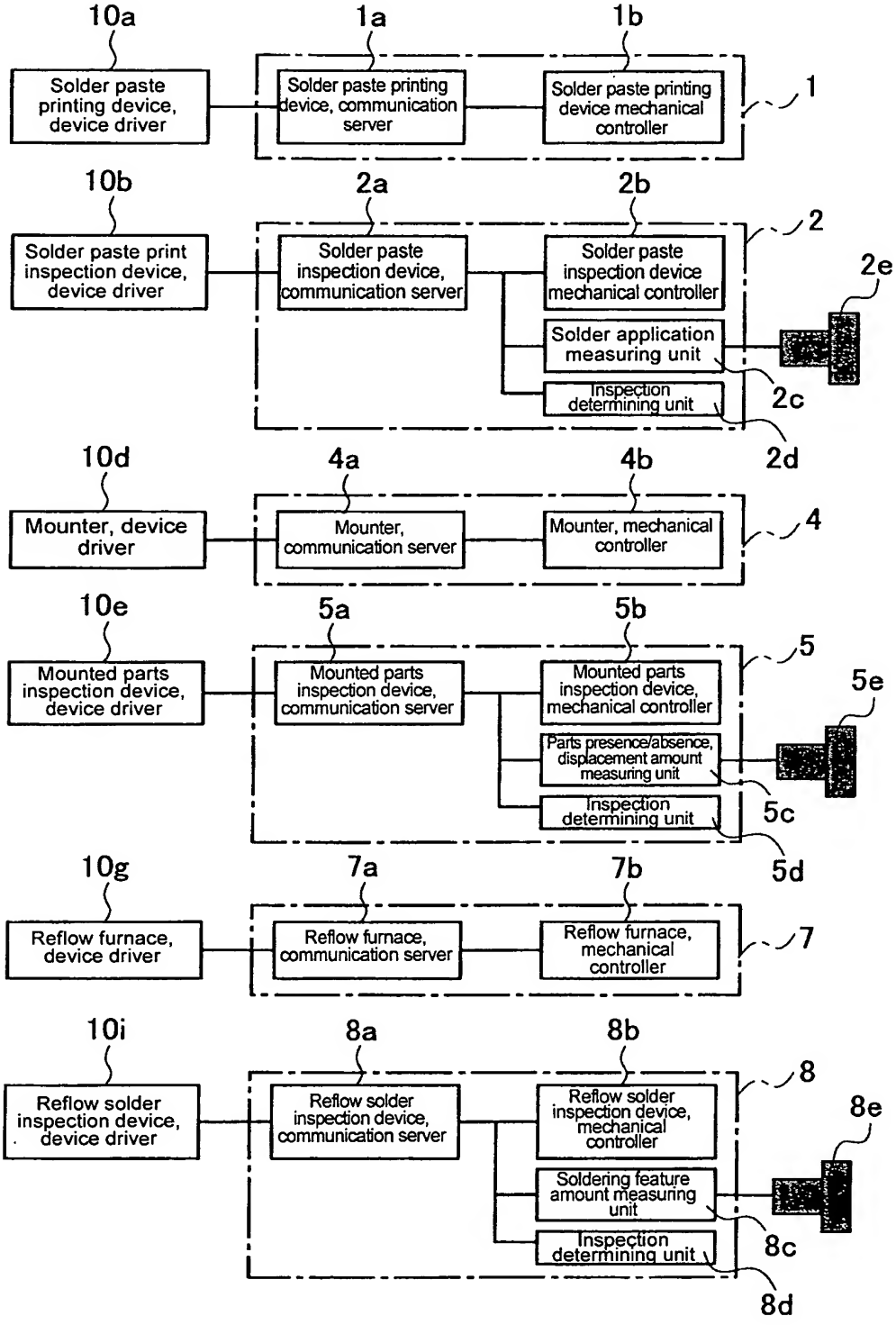

10a
1a
1b
Solder paste printing device, device driver
Solder paste printing device, communication server
Solder paste printing device mechanical controller
1
10b
2a
2b
Solder paste print inspection device, device driver
Solder paste inspection device, communication server
Solder paste inspection device mechanical controller
Solder application measuring unit
Inspection determining unit
2
2e
2c
2d
10d
4a
4b
Mounter, device driver
Mounter, communication server
Mounter, mechanical controller
4
10e
5a
5b
Mounted parts inspection device, device driver
Mounted parts inspection device, communication server
Mounted parts inspection device, mechanical controller
Parts presence/absence, displacement amount measuring unit
Inspection determining unit
5
5e
5c
5d
10g
7a
7b
Reflow furnace, device driver
Reflow furnace, communication server
Reflow furnace, mechanical controller
7
10i
8a
8b
Reflow solder inspection device, device driver
Reflow solder inspection device, communication server
Reflow solder inspection device, mechanical controller
Soldering feature amount measuring unit
Inspection determining unit
8
8e
8c
8d

Fig. 4A

Data
Number of records
Record 1
• • •
Record n

Data structure of data storage

Fig. 4B

Data
Board ID
Solder paste printing work starting time
Solder paste printing work finish time
Solder paste print inspection starting time
Solder paste print inspection result information
Solder position information
Solder height information
Solder paste print inspection finish time
Part mounting work starting time
Part mounting work finish time
Mounted parts inspection starting time
Mounted parts inspection result information
Mounted parts inspection finish time
Mounted parts position information
Reflow starting time
In-reflow temp information
Reflow finish time
Reflow solder inspection starting time
Reflow solder inspection result information
Reflow solder inspection finish time
Additional measuring device information 1
• • •
Additional measuring device information 2

Contents of each record

Fig. 5

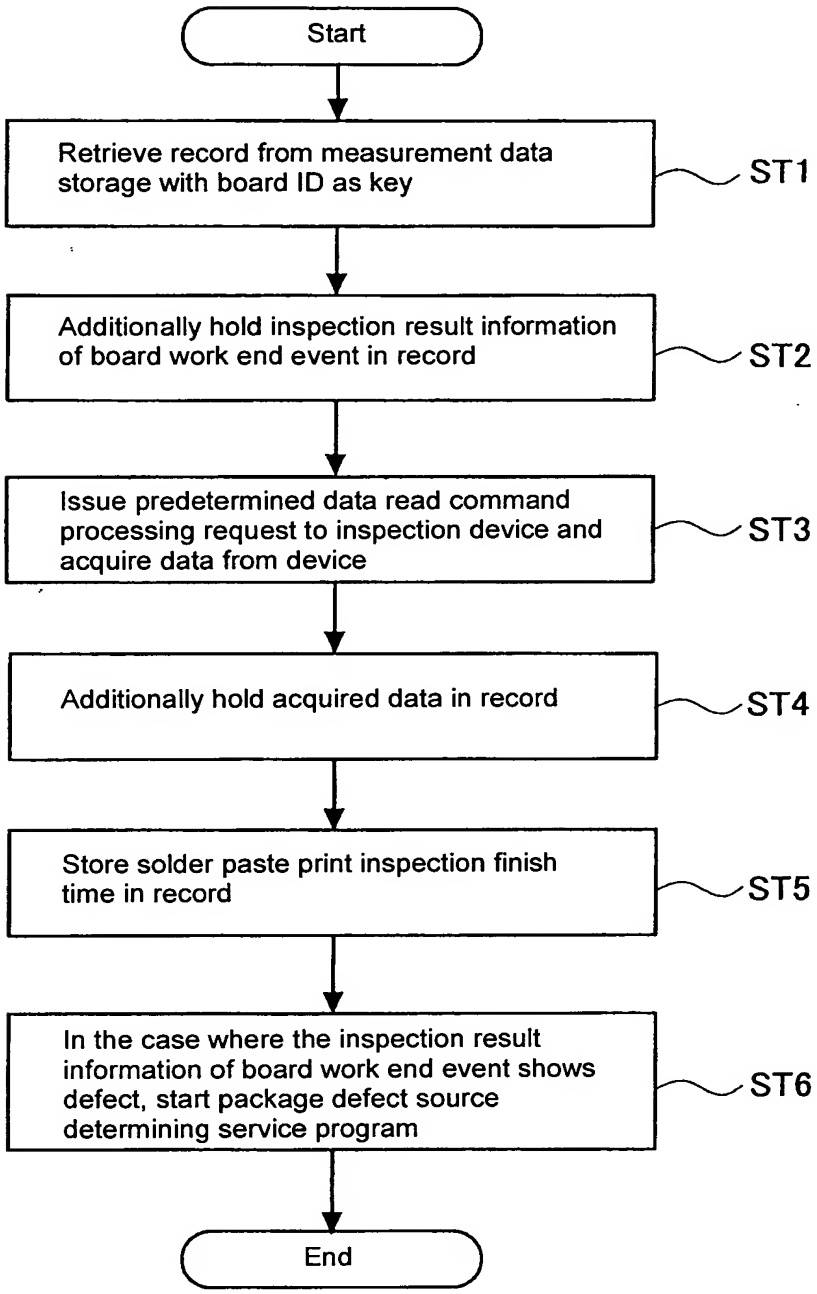

Start
Retrieve record from measurement data storage with board ID as key
ST1
Additionally hold inspection result information of board work end event in record
ST2
Issue predetermined data read command processing request to inspection device and acquire data from device
ST3
Additionally hold acquired data in record
ST4
Store solder paste print inspection finish time in record
ST5
In the case where the inspection result information of board work end event shows defect, start package defect source determining service program
ST6
End

Fig. 6

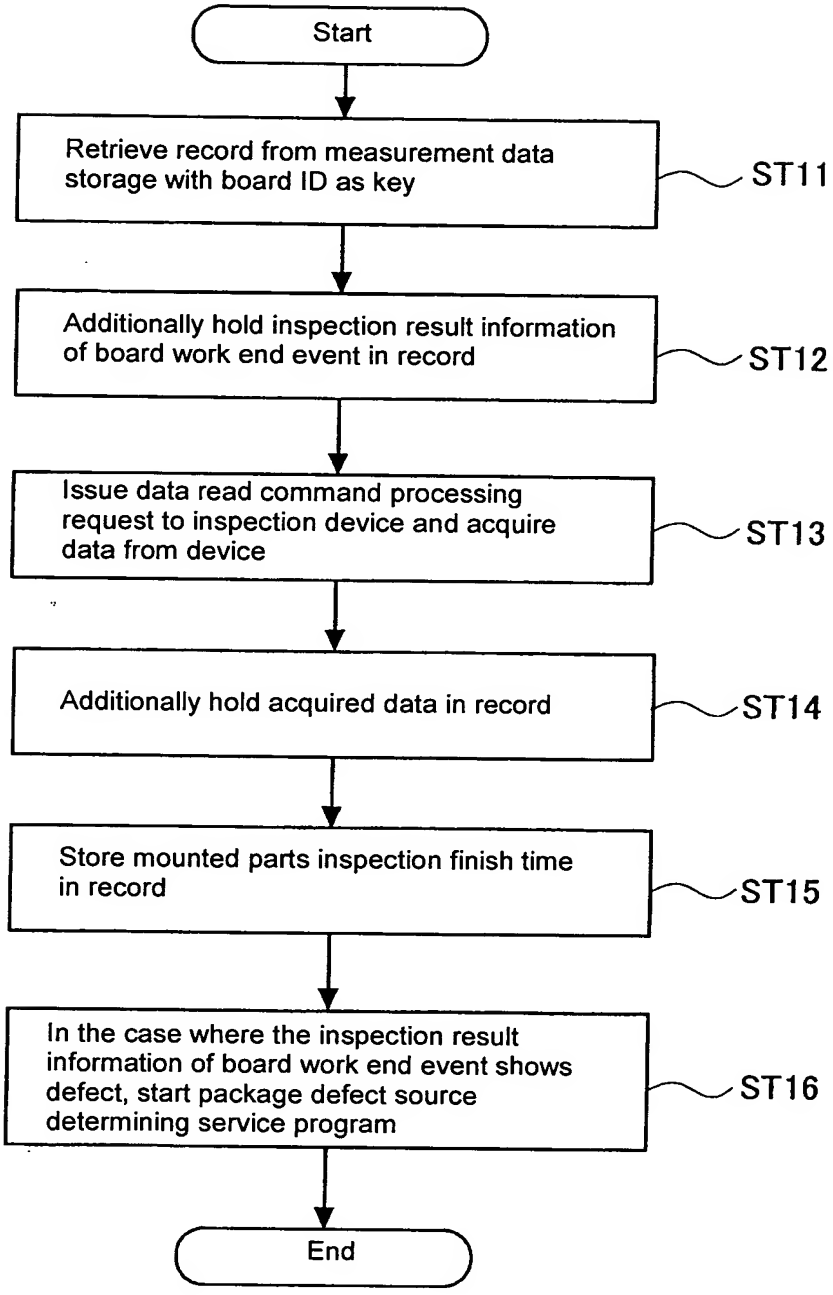

Start
Retrieve record from measurement data storage with board ID as key
ST11
Additionally hold inspection result information of board work end event in record
ST12
Issue data read command processing request to inspection device and acquire data from device
ST13
Additionally hold acquired data in record
ST14
Store mounted parts inspection finish time in record
ST15
In the case where the inspection result information of board work end event shows defect, start package defect source determining service program
ST16
End

Fig. 7

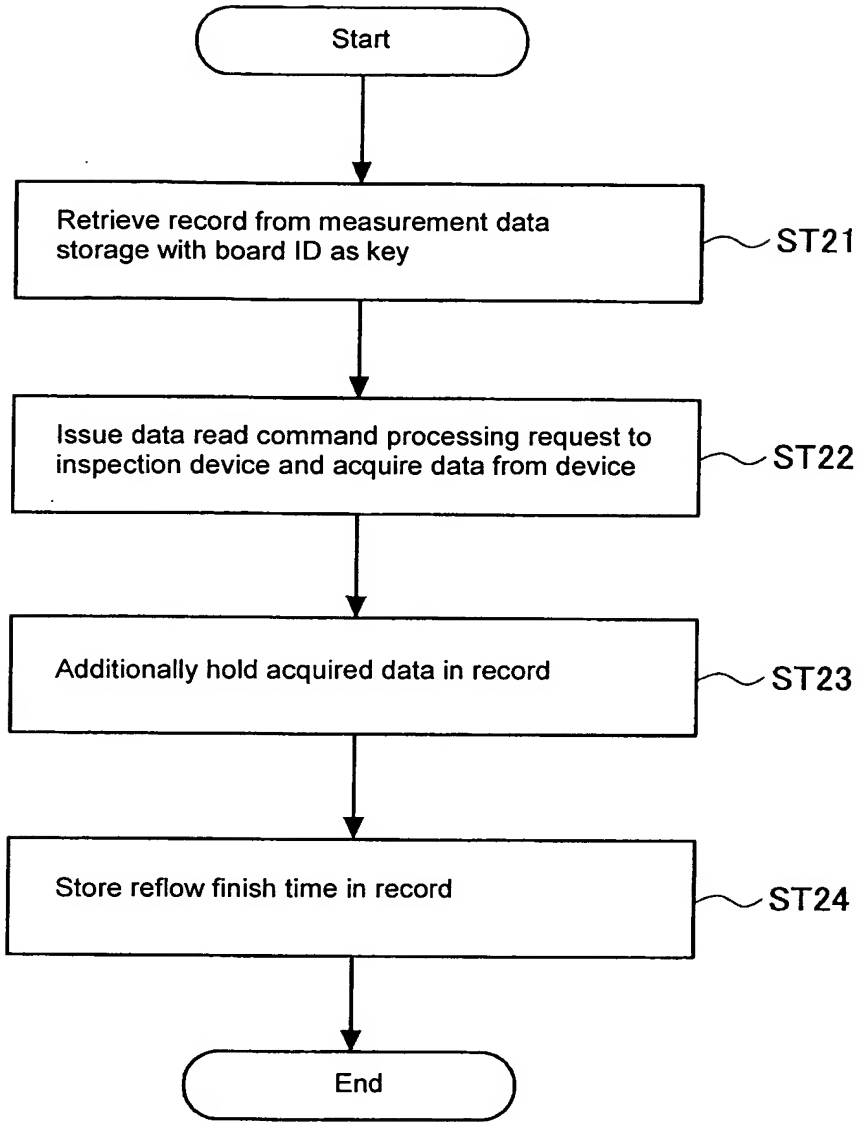
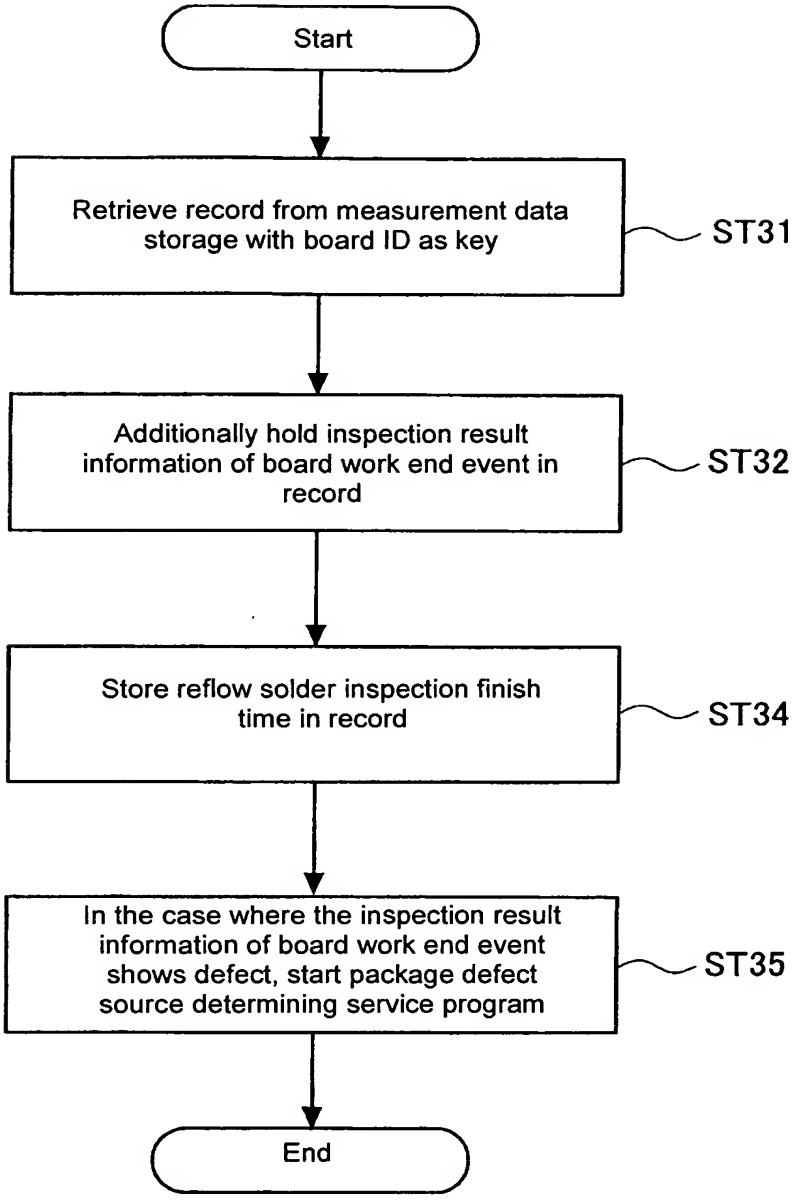

Start
Retrieve record from measurement data storage with board ID as key
ST21
Issue data read command processing request to inspection device and acquire data from device
ST22
Additionally hold acquired data in record
ST23
Store reflow finish time in record
ST24
End

Fig. 8


Start
Retrieve record from measurement data storage with board ID as key
ST31
Additionally hold inspection result information of board work end event in record
ST32
Store reflow solder inspection finish time in record
ST34
In the case where the inspection result information of board work end event shows defect, start package defect source determining service program
ST35
End

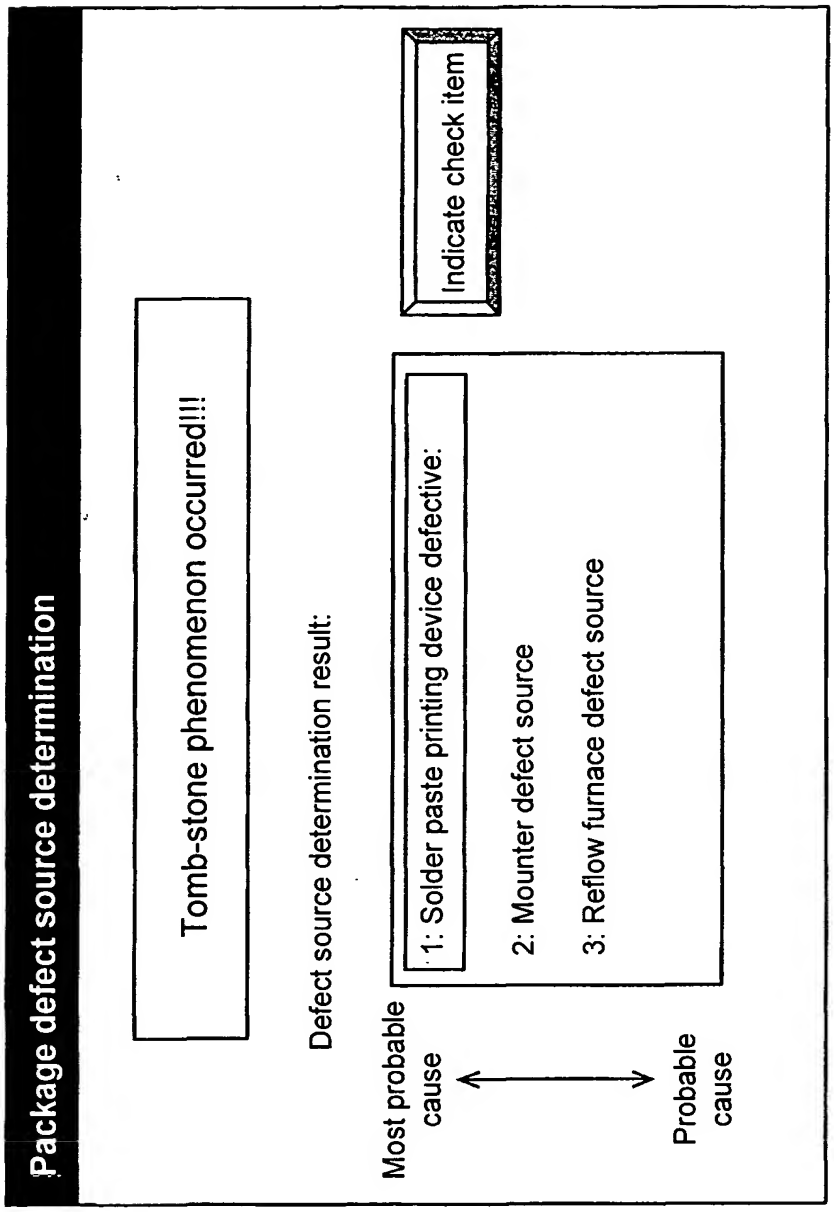

Package defect source determination
Tomb-stone phenomenon occurred!!!
Defect source determination result:
Most probable cause
1: Solder paste printing device defective:
2: Mounter defect source
3: Reflow furnace defect source
Probable cause
Indicate check item

Fig. 9

Fig. 10A

Data
Production line name
Number of devices
Device designating information 1
• • •
Device designating information n

Service setting information

Fig. 10B

Data
Device type
Device name
Device instance name

Device designating information

Fig. 10C

Data
Production line name
Solder paste printing device Device designating information
Solder paste print inspection device Device designating information
Mounter device designating information 1
Mounter device designating information 2
Mounter device designating information 3
Mounted parts inspection device Device designating information
Reflow furnace device designating information
Reflow solder inspection device Device designating information

Service parameters

Fig. 11

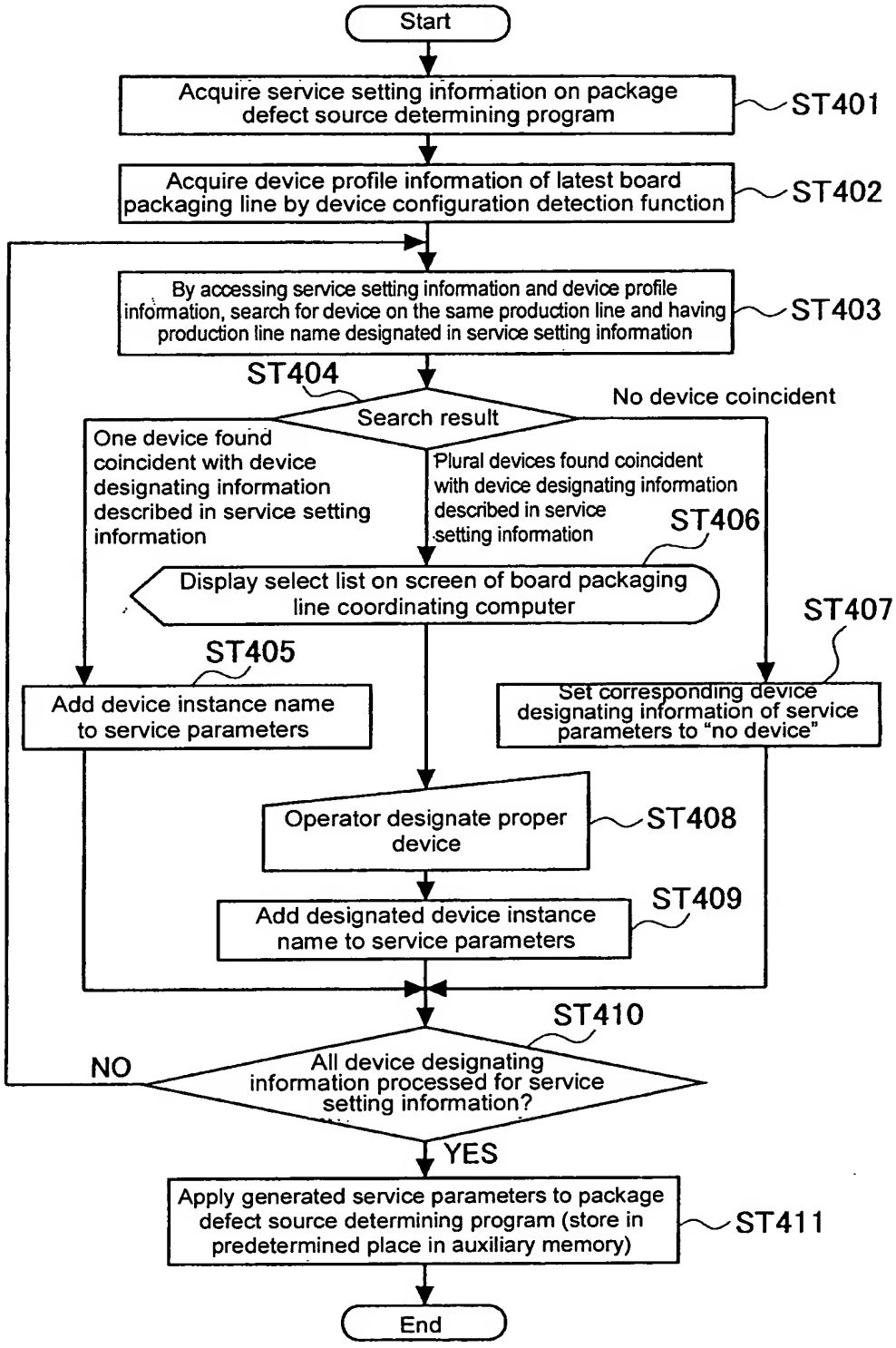
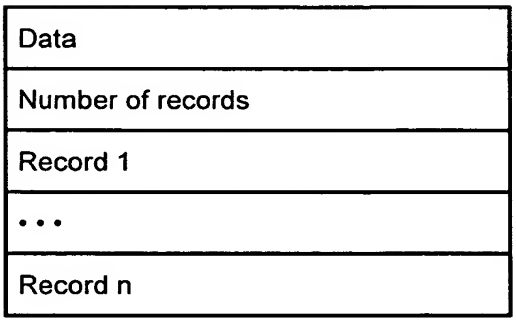
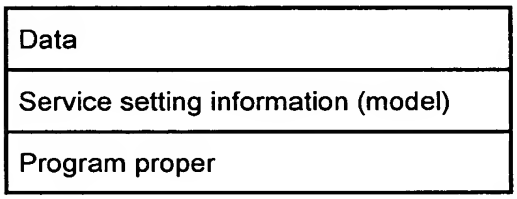

Start
Acquire service setting information on package defect source determining program
ST401
Acquire device profile information of latest board packaging line by device configuration detection function
ST402
By accessing service setting information and device profile information, search for device on the same production line and having production line name designated in service setting information
ST403
ST404
Search result
No device coincident
One device found coincident with device designating information described in service setting information
Plural devices found coincident with device designating information described in service setting information
ST406
Display select list on screen of board packaging line coordinating computer
ST407
ST405
Add device instance name to service parameters
Set corresponding device designating information of service parameters to "no device"
Operator designate proper device
ST408
Add designated device instance name to service parameters
ST409
ST410
NO
All device designating information processed for service setting information?
YES
Apply generated service parameters to package defect source determining program (store in predetermined place in auxiliary memory)
ST411
End

Fig. 12A



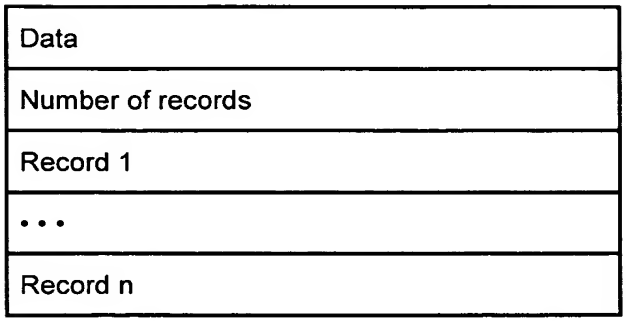
Data structure of program pool

Fig. 12B



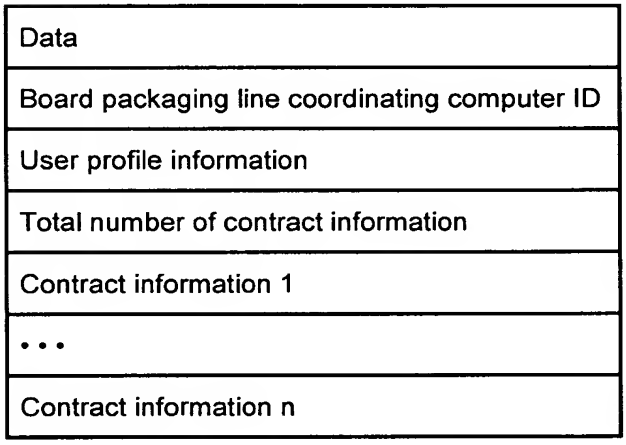
Contents of each record

Fig. 13A



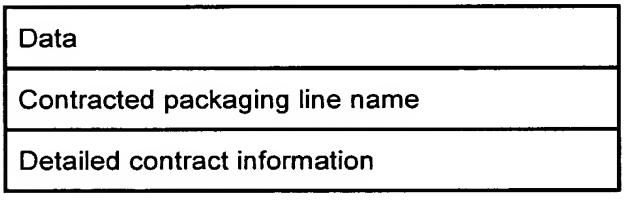
Customer data base

Fig. 13B



Contents of record

Fig. 13C



Contents of contract information

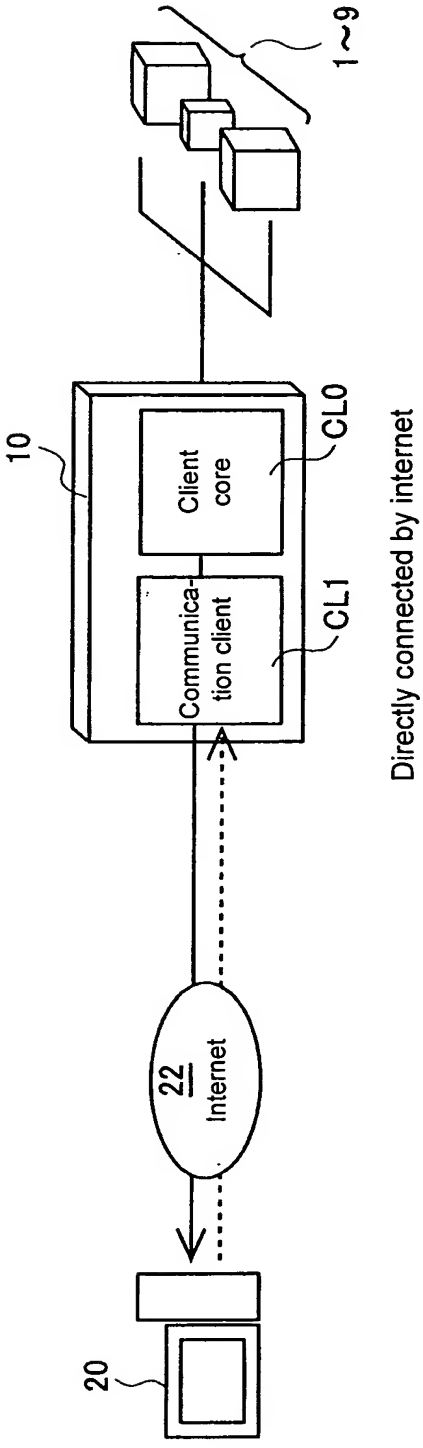


Fig. 14A

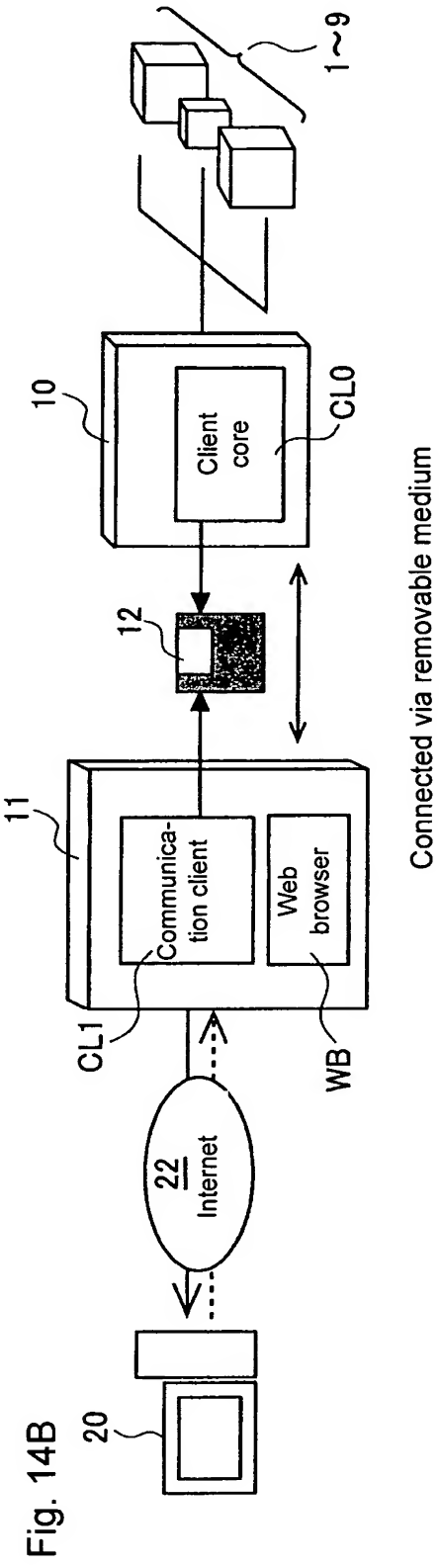
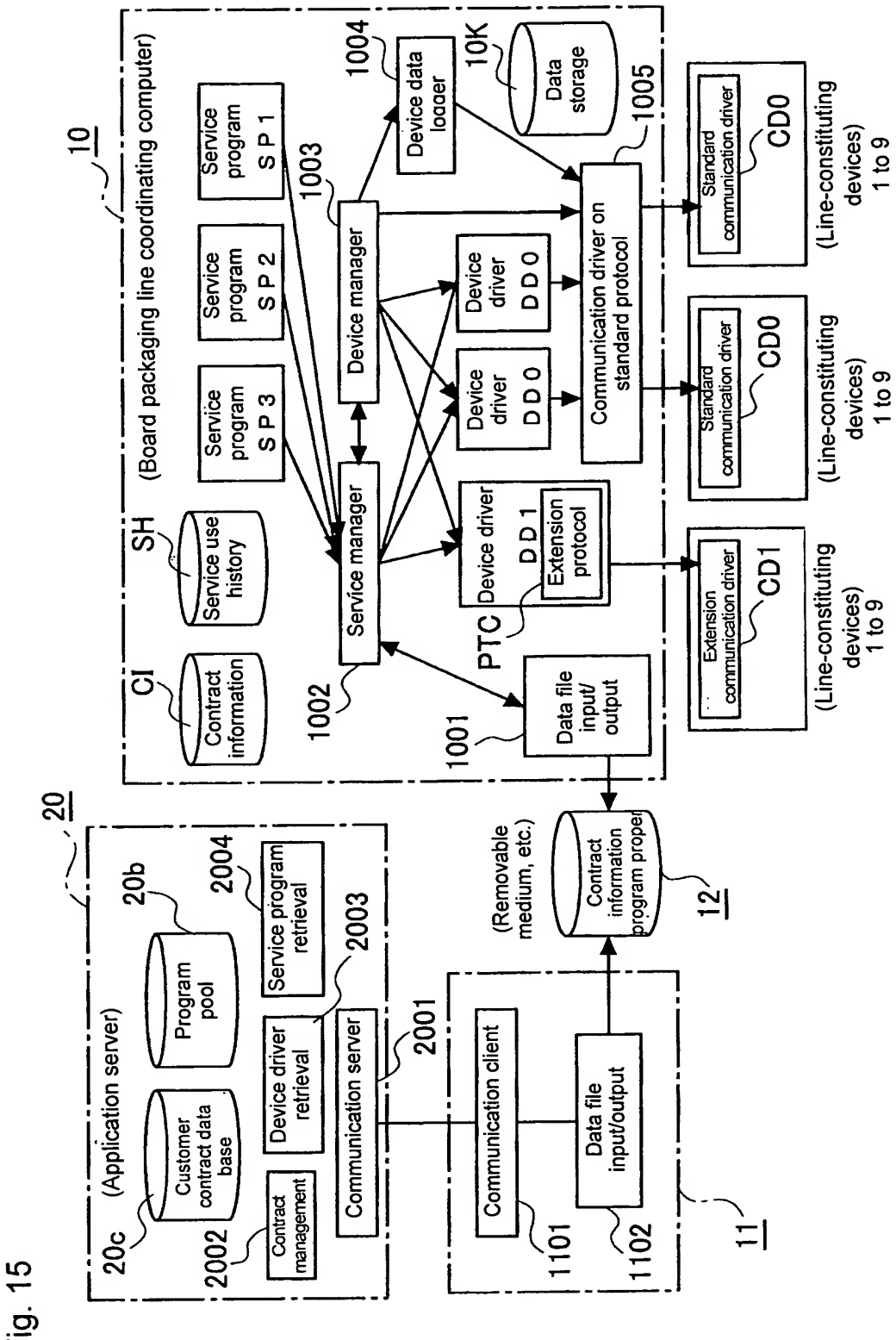


Fig. 14B

Fig. 15


10
(Board packaging line coordinating computer)
CI
Contract information
SH
Service use history
Service program SP3
Service program SP2
Service program SP1
1002
Service manager
Device manager
1003
1004
Device data logger
10K
Data storage
1005
Communication driver on standard protocol
Device driver DD0
Device driver DD0
Device driver DD1
Extension protocol
PTC
1001
Data file input/output
Standard communication driver
CD0
(Line-constituting devices) 1 to 9
Standard communication driver
CD0
(Line-constituting devices) 1 to 9
Extension communication driver
CD1
(Line-constituting devices) 1 to 9
20
(Application server)
20c
Customer contract data base
20b
Program pool
2004
Service program retrieval
2003
Device driver retrieval
2002
Contract management
Communication server
2001
(Removable medium, etc.)
Contract information program proper
12
Communication client
Data file input/output
1101
1102
11

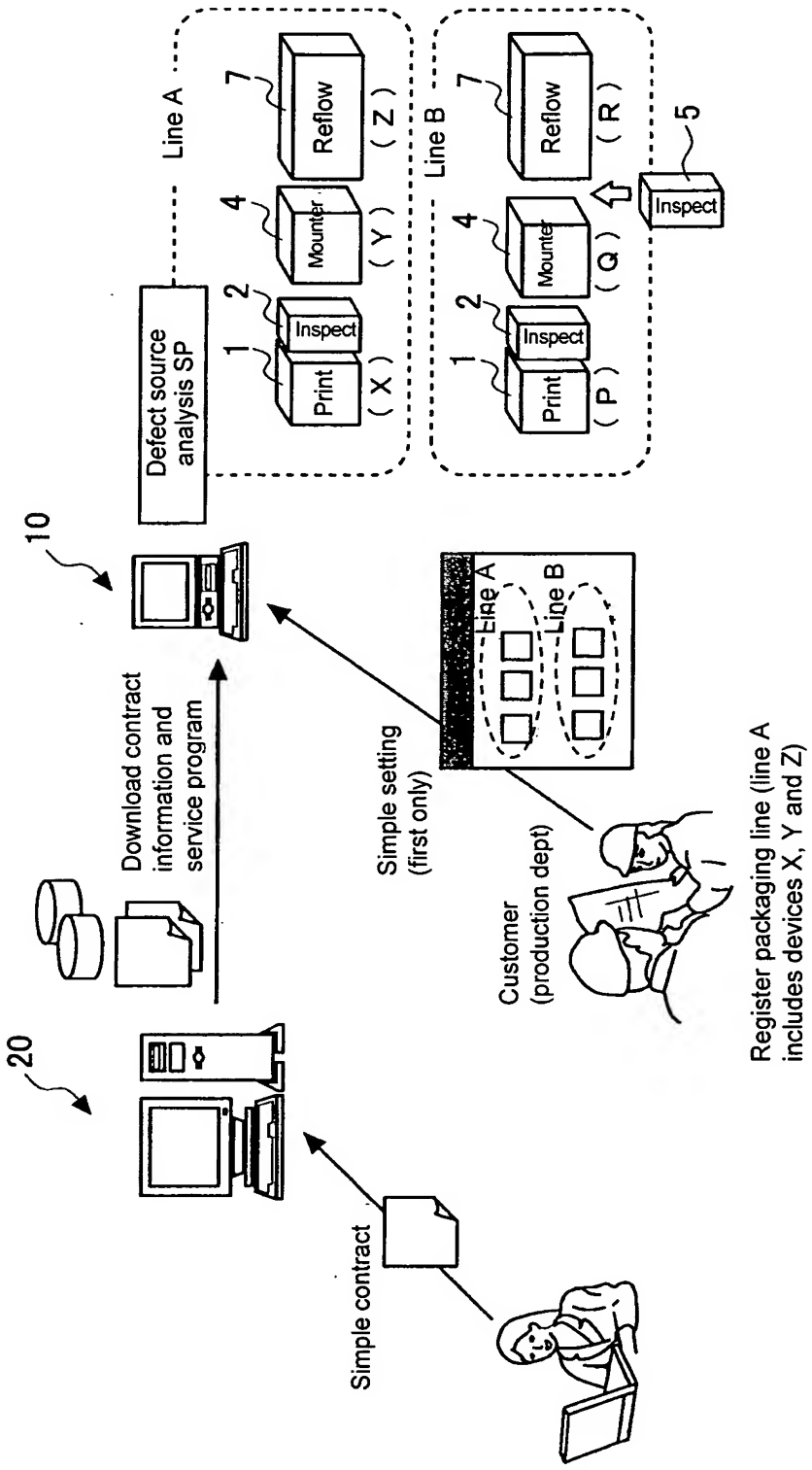

Line A
Line B
Defect source analysis SP
Print
Inspect
Mounter
Reflow
(X)
(Y)
(Z)
(P)
(Q)
(R)
1
2
4
7
5
10
20
Download contract information and service program
Simple setting (first only)
Customer (production dept)
Register packaging line (line A includes devices X, Y and Z)
Simple contract

Fig. 16

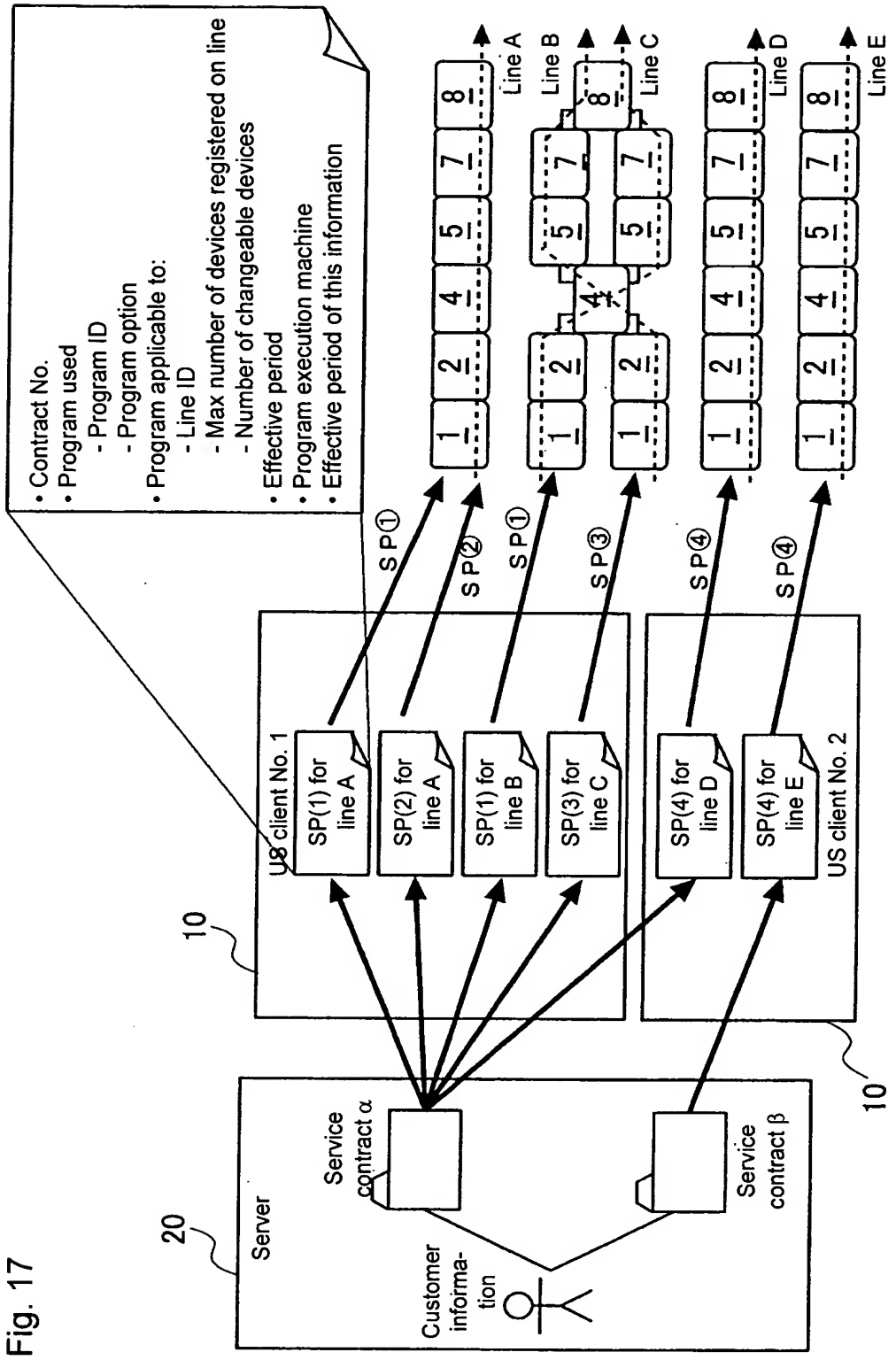
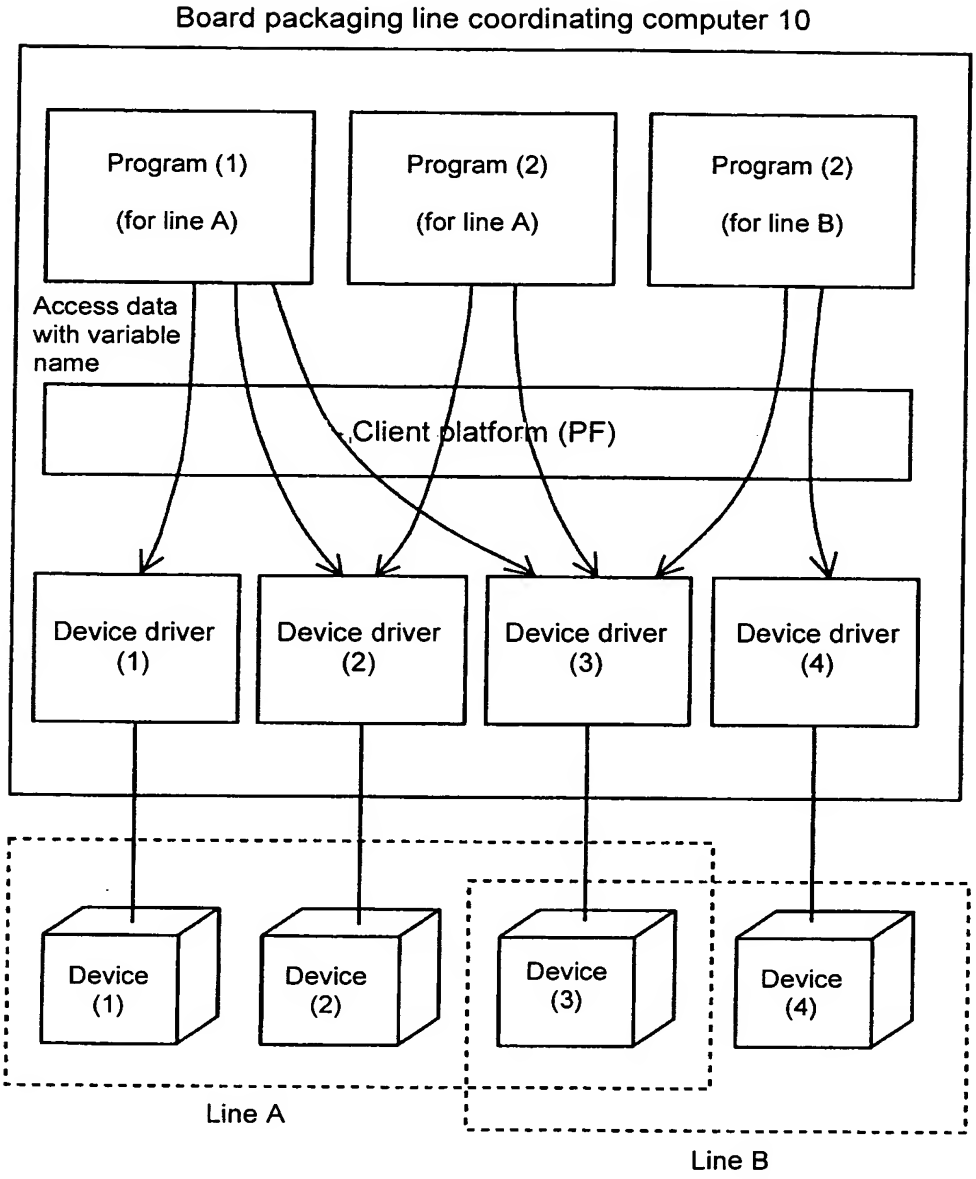

• Contract No.
• Program used
- Program ID
- Program option
• Program applicable to:
- Line ID
- Max number of devices registered on line
- Number of changeable devices
• Effective period
• Program execution machine
• Effective period of this information
Line A
Line B
Line C
Line D
Line E
SP①
SP②
SP①
SP③
SP④
SP④
US client No. 1
SP(1) for line A
SP(2) for line A
SP(1) for line B
SP(3) for line C
US client No. 2
SP(4) for line D
SP(4) for line E
10
10
20
Server
Service contract α
Service contract β
Customer informa-tion

Fig. 17

Fig. 18


Board packaging line coordinating computer 10
Program (1)
(for line A)
Program (2)
(for line A)
Program (2)
(for line B)
Access data with variable name
Client platform (PF)
Device driver (1)
Device driver (2)
Device driver (3)
Device driver (4)
Device (1)
Device (2)
Device (3)
Device (4)
Line A
Line B

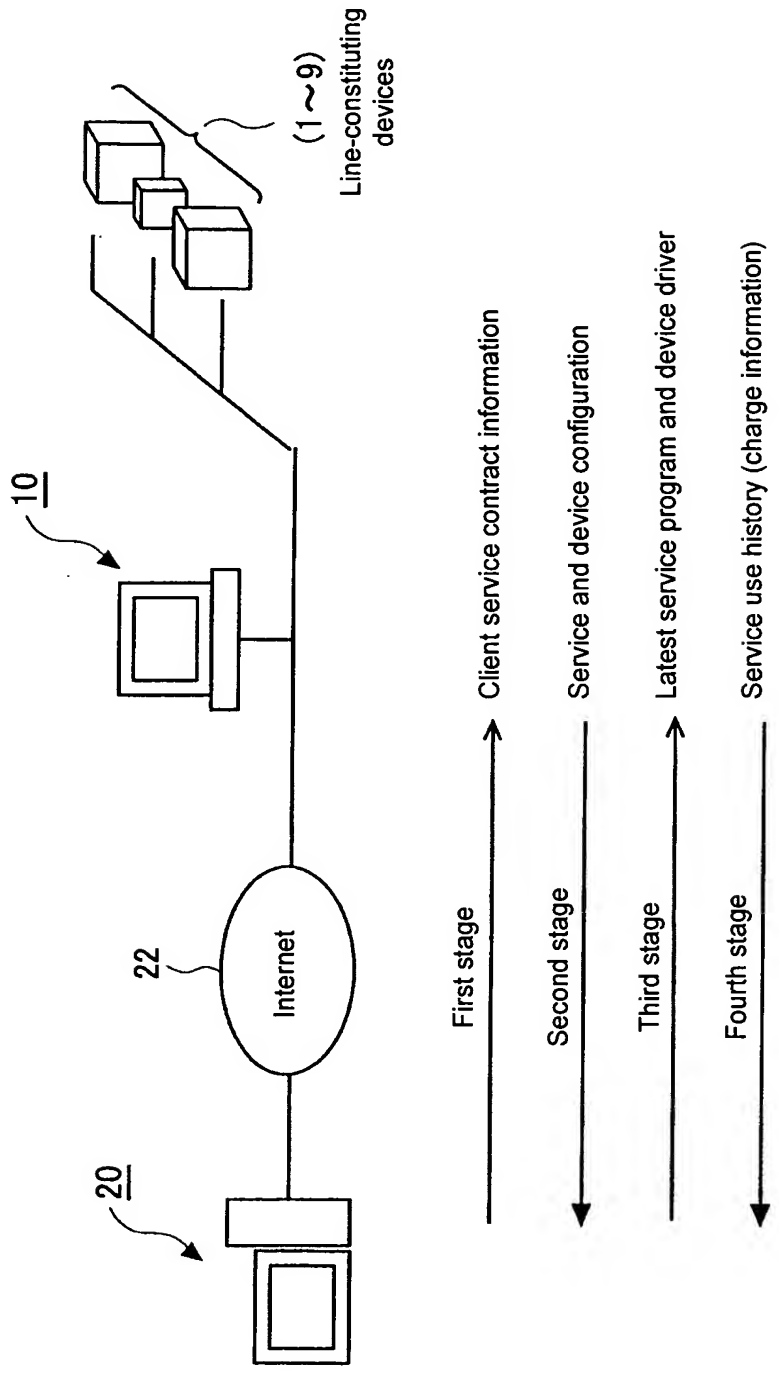
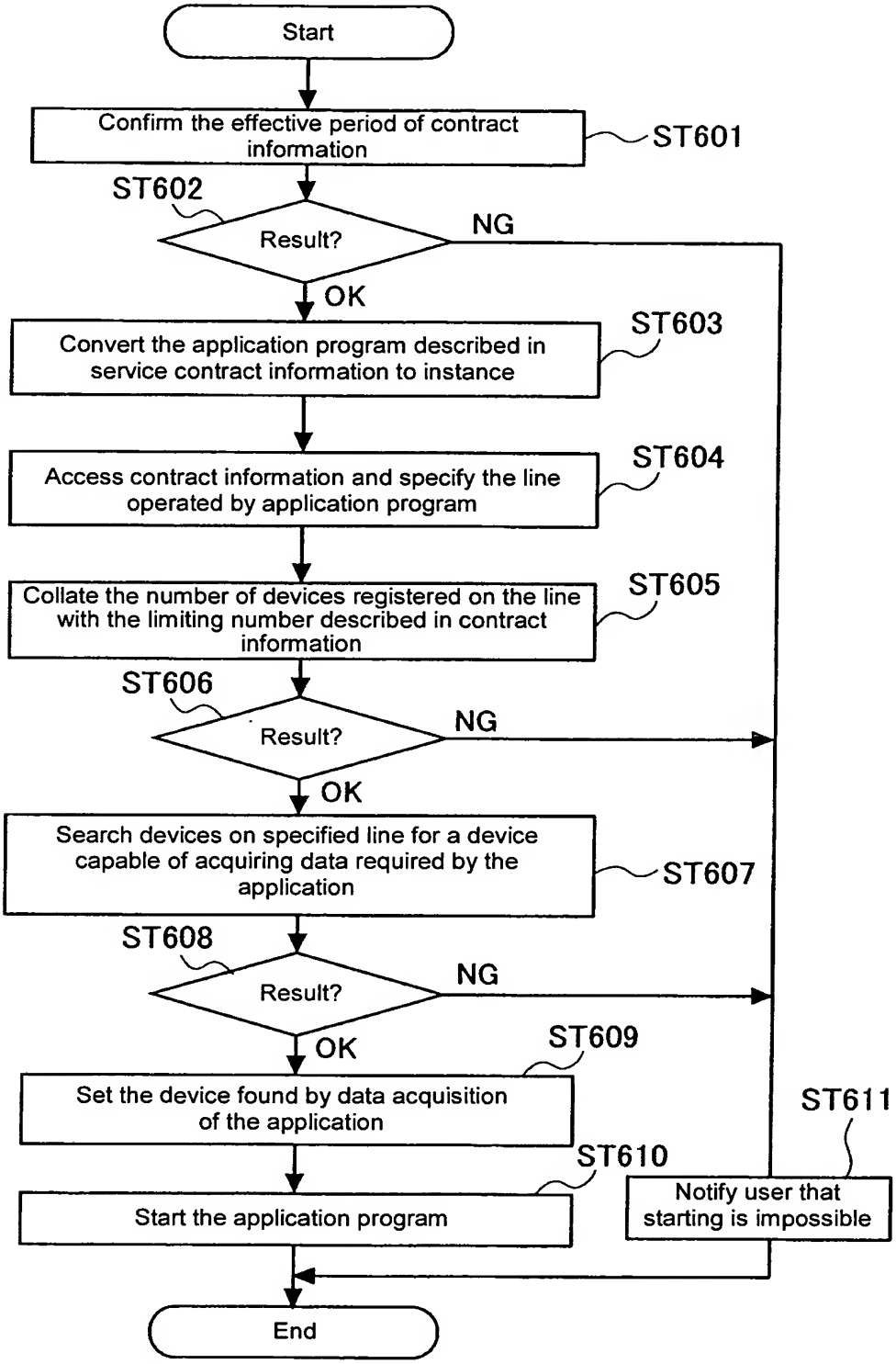

(1~9)
Line-constituting devices
10
22
Internet
20
First stage
Client service contract information
Second stage
Service and device configuration
Third stage
Latest service program and device driver
Fourth stage
Service use history (charge information)

Fig. 19

Fig. 20

Name	Description
Service contract ID No.	Number for specifying service contract managed by server in correspondence with customer information
Service contract name	Title name
Effective period starting date	Starting day of period during which execution of application program is permitted under contract
Last date of effective period	Last day of the period during which execution of application program is permitted under contract
Client ID	ID of user site service client permitted to execute the application program
Program ID	ID for designating the application program that can be used under contract
SP option character string	Character string read by application program and used for option setting (on/off of specific function). Format dependent on US application program
Applicable line ID	ID indicating line covered by the contract
Maximum number of registered devices	Limited value of total number of devices registered on applicable line under contract
Number of device registration changes allowed	Number of configuration changes allowed after starting application program
Effective period of information	Effective period from contract information acquisition by user site service client from server. In the case where data is exchanged with server and effective period is not renewed before expiry thereof, client software prohibits execution of the application program. *Effective period of 0 day indicates no effective period.

Fig. 21


Start
Confirm the effective period of contract information
ST601
ST602
Result?
NG
OK
Convert the application program described in service contract information to instance
ST603
Access contract information and specify the line operated by application program
ST604
Collate the number of devices registered on the line with the limiting number described in contract information
ST605
ST606
Result?
NG
OK
Search devices on specified line for a device capable of acquiring data required by the application
ST607
ST608
Result?
NG
OK
ST609
Set the device found by data acquisition of the application
ST610
Start the application program
ST611
Notify user that starting is impossible
End

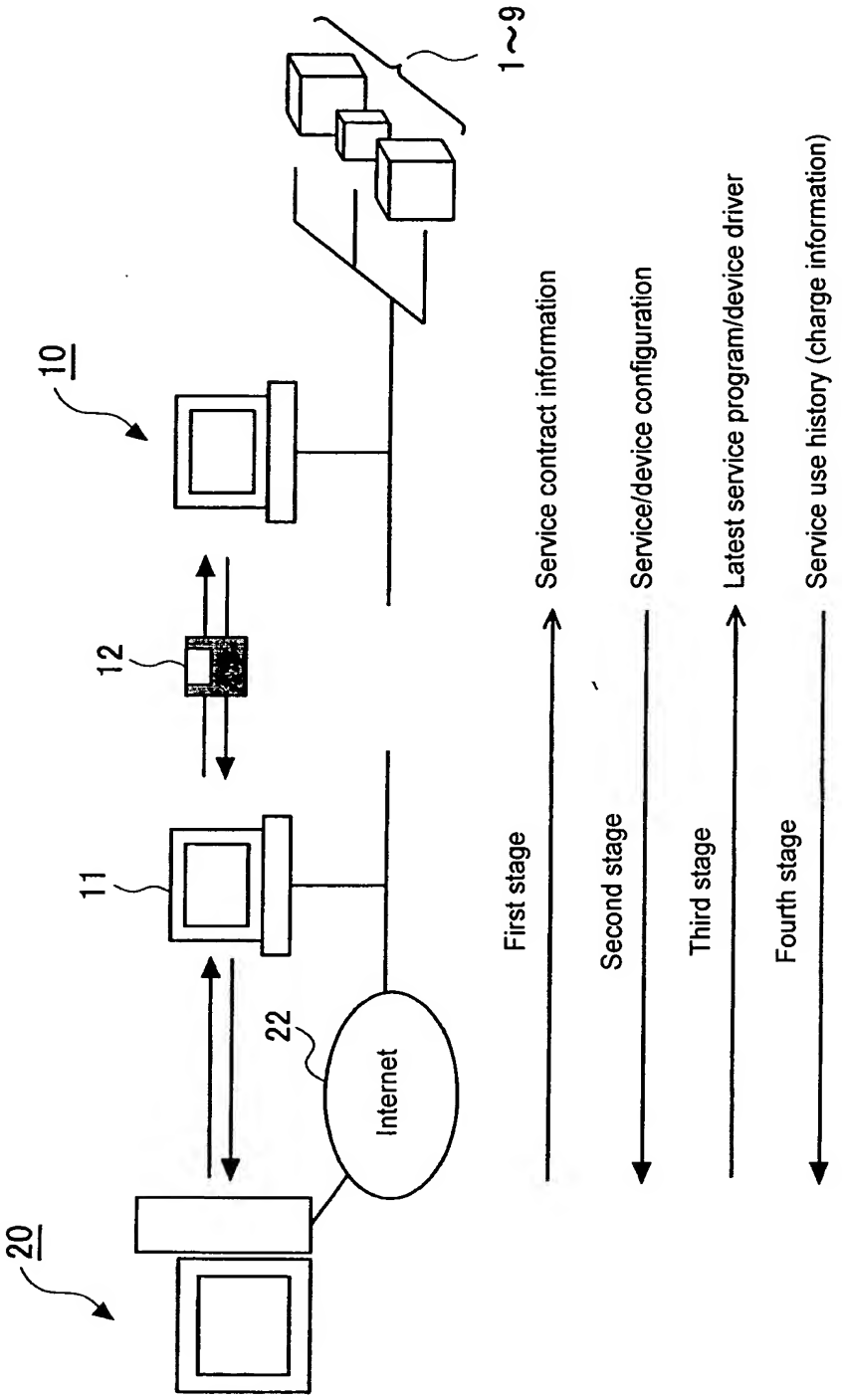

1~9
10
12
11
22
Internet
20
First stage
Service contract information
Second stage
Service/device configuration
Third stage
Latest service program/device driver
Fourth stage
Service use history (charge information)

Fig. 22

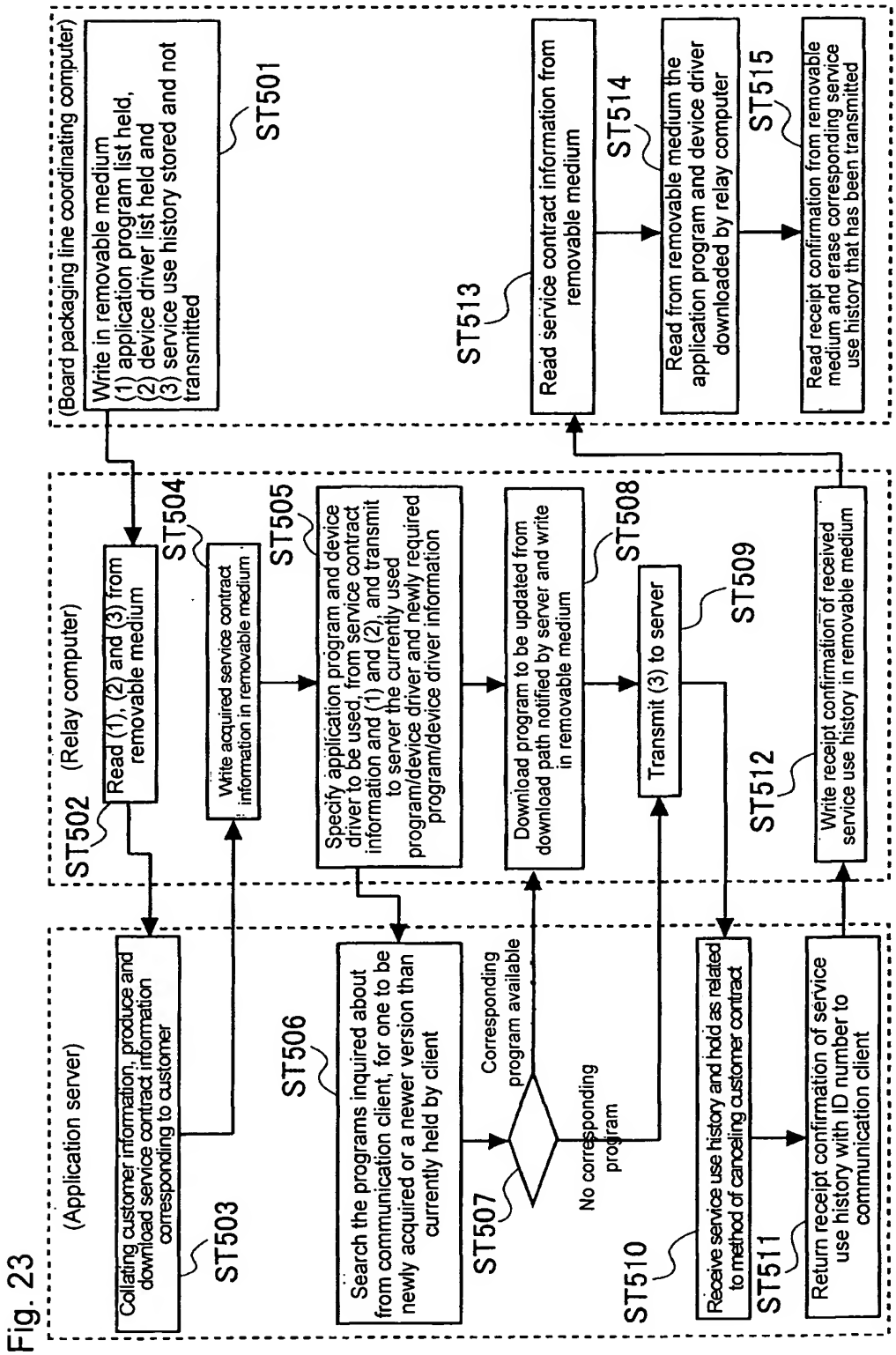
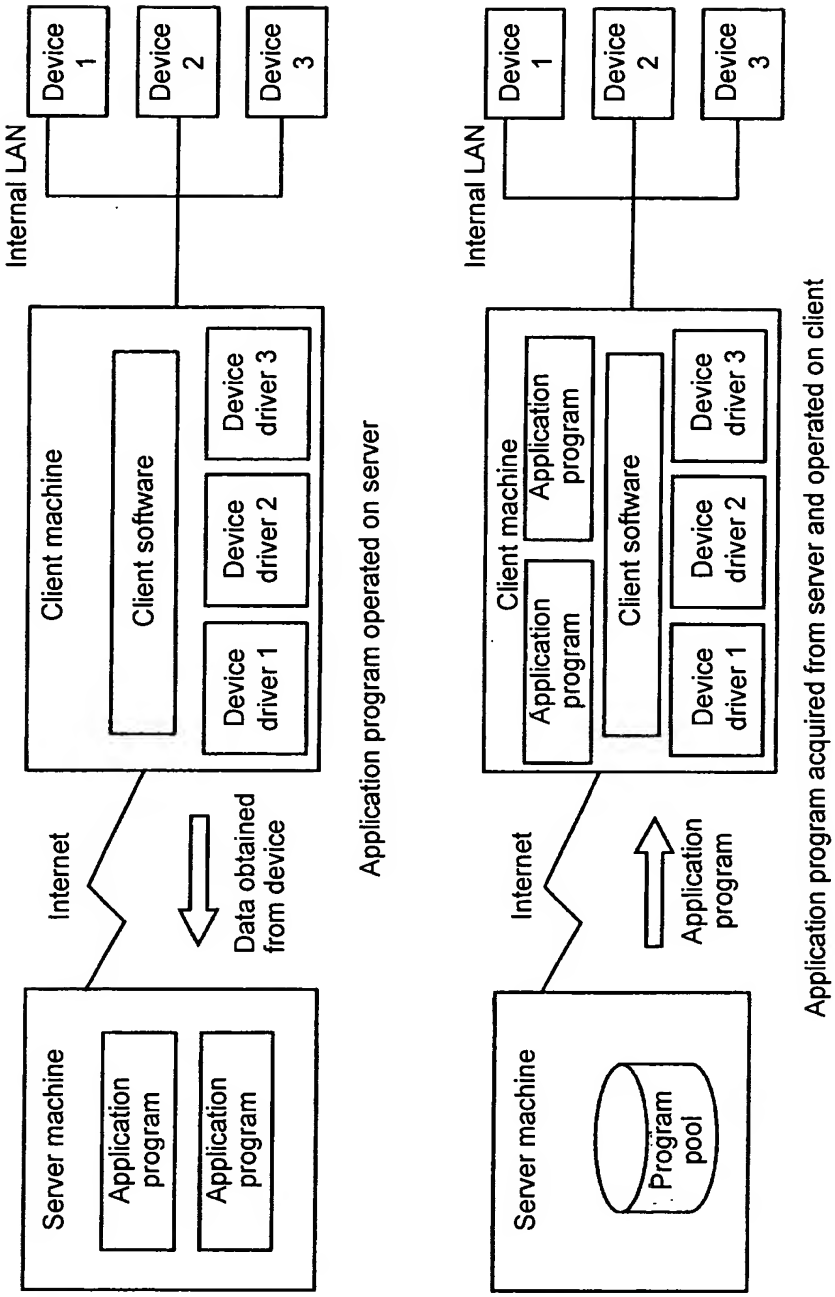

(Board packaging line coordinating computer)
Write in removable medium
(1) application program list held,
(2) device driver list held and
(3) service use history stored and not transmitted
ST501
ST513
Read service contract information from removable medium
ST514
Read from removable medium the application program and device driver downloaded by relay computer
ST515
Read receipt confirmation from removable medium and erase corresponding service use history that has been transmitted
(Relay computer)
ST502
Read (1), (2) and (3) from removable medium
ST504
Write acquired service contract information in removable medium
ST505
Specify application program and device driver to be used, from service contract information and (1) and (2), and transmit to server the currently used program/device driver and newly required program/device driver information
Download program to be updated from download path notified by server and write in removable medium
ST508
Transmit (3) to server
ST509
ST512
Write receipt confirmation of received service use history in removable medium
(Application server)
Collating customer information, produce and download service contract information corresponding to customer
ST503
ST506
Search the programs inquired about from communication client, for one to be newly acquired or a newer version than currently held by client
ST507
Corresponding program available
No corresponding program
ST510
Receive service use history and hold as related to method of canceling customer contract
ST511
Return receipt confirmation of service use history with ID number to communication client

Fig. 23

Fig. 24


Device 1
Device 2
Device 3
Internal LAN
Client machine
Client software
Device driver 1
Device driver 2
Device driver 3
Internet
Data obtained from device
Server machine
Application program
Application program
Application program operated on server
Device 1
Device 2
Device 3
Internal LAN
Client machine
Application program
Application program
Client software
Device driver 1
Device driver 2
Device driver 3
Internet
Application program
Server machine
Program pool
Application program acquired from server and operated on client